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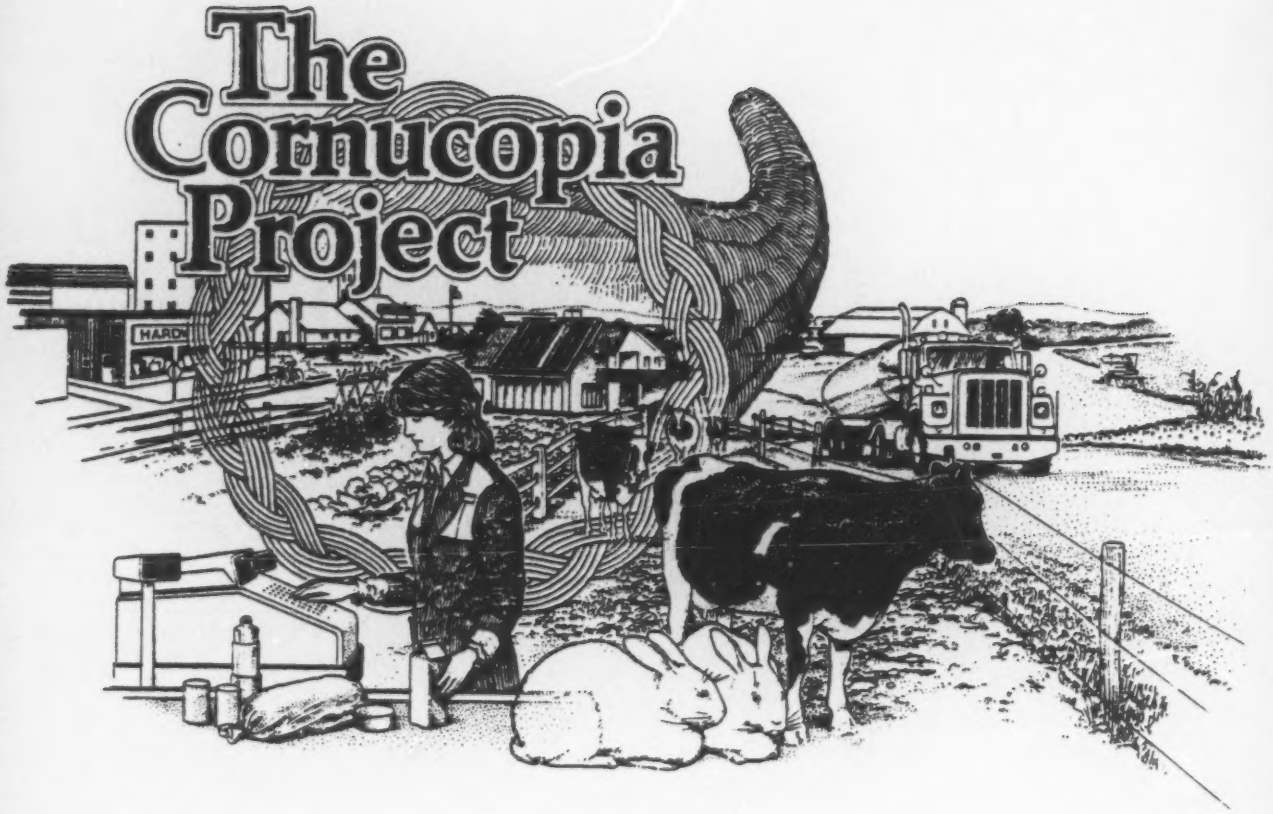

THE ARIZONA FOOD SYSTEM: RUNNING ON EMPTY?

A Study of the Food System of Arizona by
BRAD HILL

with

The Cornucopia Project of Rodale Press
33 East Minor Street
Emmaus, Pennsylvania 18049
Phone: (215) 967-5171

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TABLE OF CONTENTS

Introduction i

Arizona's Food System Today—The Disturbing Facts 1

What Do These Facts Mean? 13

What Can We Do? 15

Farmers 17

Consumers 21

State 22

Footnotes 28

Appendix: Arizona Food Imports Chart 32

Footnotes to Food Imports Chart 38

Appendix 2: Arizona Food System Organizations 39

INTRODUCTION

-In California, agricultural officials desperately try to contain the Mediterranean Fruit Fly infestation, before the insects' larvae totally ruin dozens of different fruit and vegetable crops grown commercially in that state. As aerial sprayings are expanded to cover increasingly wider areas, growers in other states express concern about "Medfly" contamination of their crops, and call for embargoes against California produce.

-In Florida, a single night's freeze destroys a major portion of the state's citrus crop and many of the vegetables it grows for the winter market. The loss is reflected almost immediately throughout the United States by a jump in the price of orange juice concentrate and a shortage of some fresh vegetables.

-In Mexico, truck drivers stage a nationwide strike during early January, threatening to disrupt the flow of winter vegetables to the United States. A negotiated settlement ends the strike after one week.

-In Geneva, Switzerland, OPEC nations meet and agree to establish a new, unified oil price, which analysts predict will result in another worldwide increase in prices for petroleum products.

Each of these recent news events occurred far outside the boundaries of Arizona, yet each event had the potential to affect the cost and availability of food within our state. Each incident offered an example of the Arizona food system's dependence on political, economic, and environmental factors in other parts of the United States, and even in other parts of the world. Such dependence means vulnerability,

because the welfare of Arizona's food system is determined by distant people and events, over which Arizonans have little control.

Any one of a number of possible crises--natural or human-made--could have disastrous consequences for Arizona consumers. A natural calamity cutting off food shipments from California (this almost happened during the 1981 Medfly infestation) would make many types of fresh produce unavailable or unaffordable in Arizona supermarkets. California supplies 41 percent of the fresh fruits and vegetables consumed in the United States, and as an immediate neighbor of the Golden State, it is a pretty safe bet that Arizona imports even larger quantities of California produce.

Mexico is another major source of fresh fruits and vegetables for Arizona and the U.S., especially during winter months. In February of 1980 alone, over 280 million pounds of Mexican-grown produce came over the border through Nogales.[1] A prolonged strike by Mexican truck drivers, an international quarantine on Mexican produce following crop disease problems, a serious drought, or a change in potential relations between the U.S. and Mexico could shut off another important source of Arizona's food.

A nationwide truck drivers strike in the U.S. would be even more disastrous to our food supply. Ninety-nine percent of all livestock, 88 percent of all fresh produce, and 80 percent of all meats, dairy products and bakery goods in this country are moved by truck.[2] A sudden halting of truck transportation would devastate Arizona in two ways: imports of food, fuel, and other essential goods would be cut off, while the state's economy would lose tremendous amounts of income because of its inability to export surplus cash crops.

An oil embargo or a sudden, steep price increase by the OPEC nations could also endanger our supply of food. Petroleum availability and cost is important because of its effect on the food transportation system, and because Arizona's agriculture is dependent on energy-intensive irrigation, chemical fertilizers, pesticides, and farm machinery. Since crop production in Arizona consumes five times as much energy per acre as does the average U.S. farm, many growers in the state might not be able to cope with another oil embargo or a round of major price increases.[3]

Even without any of these hypothetical crises, Arizona's farmers are in plenty of trouble. Many are badly in debt; in 1978, total outstanding farm mortgage loans amounted to over $484 million, an average of over $71,000 for each farm in the state.[4] Arizona's urban population explosion threatens to gobble up much of their best cropland, and dwindling water resources combined with increased demand for water by cities and industry may push many growers out of business. To top it all off, the state government often seems to have little interest in dealing with agricultural and food-related problems; at present, Arizona does not even have a Department of Agriculture.

ARIZONA'S FOOD SYSTEM TODAY--THE DISTURBING FACTS

Given the considerable potential for severe difficulties which could cut off much of the food that Arizona imports, or make the food too expensive for most Arizonans to buy, it is important that Arizonans take a close look at their food system. We need to examine how our food system currently functions, and how it could function to better meet the needs of Arizona consumers. Such scrutiny reveals some very disturbing facts:

-About 67 percent of all food consumed in Arizona is imported--from places like California, Mexico, and even Florida.[5] Having a food import rate of "only" 67 percent may sound good, compared to the Northeastern states, which import 80 percent or more of their food, but it still leaves Arizonans dangerously dependent upon distant, possibly unreliable food sources. This dependence adds too much to consumers' grocery bills and is unnecessary in a state with vast areas of arable lands, a wide variety of microclimes and many regions that enjoy nearly year-round growing seasons.

-Arizona consumers spend about $1.82 billion annually for imported foods; transportation of food imports alone cost almost $96 million.[6]

-Farming operations in Arizona are characterized by an extraordinarily heavy use of water, pesticides, and chemical fertilizers. Pesticides and chemical fertilizers are largely made from petroleum products and other imported materials. With the arrival of the Central Arizona Project (CAP), Arizona farmers will also be dependent on water imported from outside the state.

-The small family farm has become almost invisible in the economy of Arizona. Agriculture in the state is now dominated by huge, incorporated "agribusinesses." In 1981, Arizona had the largest average farm size in the country--5,465 acres (the U.S. average was 430 acres).[7] Although the total amount of farmland in the state has changed little over the past few decades, average farm size has increased rapidly while the total number of farms in Arizona has dropped, from 18,468 in 1940 to 7,100 in 1981—a decrease of 62 percent.[8]

On the positive side, it should be pointed out that Arizona's agricultural system does have great productive capabilities. Depending on the year, agriculture is Arizona's second, third, or fourth largest source of cash receipts.[9] In 1979, these cash receipts from all crop and livestock marketings totaled over $1.7 billion.[10] In 1980, Arizona ranked second among all states in production of durum wheat, lettuce, grapes and lemons, third in production of tangerines and cotton, fourth in oranges and grapefruit, and fifth in fresh market vegetables.[11]

In many ways, Arizona's climate is ideal for high-yield crop production. Southern Arizona, where most of the state's cropland is located, is one of the sunniest areas in the U.S., receiving 85-90 percent of all possible sunshine during a given year.[12] Many growers in Arizona enjoy over 240 frost-free days per year, and some areas such as Yuma may go an entire year without a single killing freeze.[13] While Arizona's soils are relatively low in nitrogen and organic matter, soil erosion--a serious problem for most American farmers--is very low in most parts of the state, probably due to Arizona's arid climate. In 1977, Arizona's estimated annual average sheet and rill erosion rate was 0.36 tons per acre--far below the national average rate of 4.66 tons per acre.[14]

Given these favorable conditions, along with almost unlimited access to inexpensive irrigation water, Arizona's farmers have been able to achieve remarkably high yields for some crops. Arizona cotton and alfalfa yields are about twice the national average, and durum wheat yields have been as much as two and a half times the national average.[15]

On the other hand, the advantages of long growing seasons, lots of sunshine, and low erosion rates may ultimately be negated by Arizona agriculture's biggest natural disadvantage--scarcity of water. Most of Arizona averages less than 12 inches of precipitation annually; the Yuma farming areas get less than three inches.[16] Typically, a large part of Arizona's precipitation comes during late summer, when temperatures and evaporation rates are highest. In the deserts of the Southwest, less than three percent of all rainfall ever gets to run off the land; most of the remaining 97 percent is lost to evaporation.[17]

Because of the arid environment, virtually all cropland in Arizona is irrigated. For years, this situation was taken for granted; farmers basically regarded water as an "unlimited" resource. Federally funded water projects made water almost dirt-cheap, and nobody thought very much about water conservation. However, the 1960's and 1970's saw a population explosion in Arizona's cities and the beginning of concern over how the state's water supplies could meet the needs of so many new residents and industries, along with an ever-thirstier agricultural system.

In the 1970's, Arizonans were using approximately 2.3 million acre-feet of surface water, and 2.5 million acre-feet of groundwater each year.[18] While surface water might be considered a "renewable" resource, groundwater reserves in the state are only replenished at

the rate of about 300,000 acre-feet per year. This means that groundwater reserves were being depleted at an annual rate of 2.2 million acre-feet.[19]

The results of groundwater depletion are dramatically visible in many parts of Arizona. In Tucson, groundwater tables are dropping by an average of 1.3 feet per year, in Phoenix the rate is 2.3 feet. The water level of a well in the Salt Valley fell 55 feet in a five year period during the 1970's, and another well near Sells dropped 42 feet during the same period. Subterranean vacuums, produced by groundwater pumping, sometimes cause the earth's surface to collapse and crack. One such crack, miles in length, broke up highways and railroad tracks between Tucson and Phoenix.[20]

The problem of water resources is perhaps the most emotionally-charged political issue in the American Southwest. It has led to bitter confrontations between state and local governments, between the United States and Mexico, and among farmers, industries, mines, and Indian reservations. Mexican farmers have complained that Arizonan and Californian irrigation leaves Colorado River water too salty for use south of the border. A dispute between Arizona and California over water rights became the longest legal battle in the history of the U.S. Supreme Court. At one point, the Arizona government actually declared martial law and called up the National Guard to protect its water claims from California "theft".[21]

Today, Arizona has placed its hopes for salvation from drought in the Central Arizona Project (CAP), which is supposed to bring Colorado River

water into the heart of the state, to be used by the residents of Phoenix and Tucson, various Indian reservations, and the farms and industries in central and southern Arizona. By mid 1981, CAP was still only one-third completed, and expected to cost $2.2 billion.[22] At times, various political squabbles have threatened to cancel all, or parts of, the project. Even if CAP survives all of these problems intact, its southern end will not reach Tucson until at least 1989, by which time that city may have suffered several years of serious water shortages.[23]

Even the most optimistic forecasts predict that CAP will only bring an extra 1.5 million acre-feet of water to Arizona in 1990, and that the annual total will actually decline to 1 million acre-feet by 2025, as other states along the Colorado River begin to claim their shares of its water.[24] Arizona will receive even less water if proposed shale oil plants go into operation in the Rocky Mountains and take large amounts of water from the upper reaches of the Colorado.[25]

Moreover, the 1968 Congressional Act which authorized the federal loan for CAP was passed with the condition that Arizonans must reduce their consumption of groundwater by an amount equivalent to volume of surface water they received from CAP.[26] The Arizona State Legislature dodged this problem for some 12 years, until, under heavy pressure from the Federal Government, it passed the Groundwater Act of 1980. Basically, this law mandated that the state must stop its overpumping of groundwater—by the year 2025.[27]

The difficulty in achieving this goal has been increased by Arizona's rapid population growth. With a 54 percent increase in population between 1970 and 1980, Arizona is the second fastest growing state in the country.[27a]

By the turn of the century, Arizona's population (2.7 million in 1980) is expected to reach 6 million. This means that agriculture, which currently uses 88 percent of all water consumed in the state, will face stiff demands for water from residential and industrial users in the cities.[28] These rival groups will probably get the lion's share of the water that CAP brings, while farmers will have to settle for whatever water is left over, if there is any left over at all. In Pima County, for instance, nearly 40,000 acres of cropland will only be allocated 30,000 acre-feet of CAP water annually. Droughts or higher than expected use of Colorado River water upstream from Pima County may mean even less water will be available for local agriculture. At the same time, provisions in the Groundwater Act of 1980 prohibiting overpumping will eventually prevent Pima County from drawing on more than 75,000 to 100,000 acre-feet of groundwater in a given year, all of which could go to the city of Tucson.[29]

For years, American drivers were used to cheap gasoline prices, only to be hit with the shocks of OPEC, beginning in the 1970's. For years, farmers in the American West have enjoyed artificially cheap irrigation, thanks to Federal Government subsidies. Consequently, there has been little incentive to conserve this resource. In recent years, however, farmers' bills for water and the energy needed to pump that water have increased rapidly. By 1979, irrigation accounted for 40 percent of variable production costs in growing cotton, 58 percent for growing wheat, and 65 percent for growing alfalfa.[30] As groundwater tables fall, pumping becomes more difficult and more expensive. New sources of surface water, like CAP, must be transported from more

remote regions, and often must be pumped uphill. Still, without Federal Government subsidies, irrigation water would be prohibitively expensive. CAP water, for instance, is expected to cost Arizona farmers $52 per acre-foot; but the true cost of the project (including dams and canals) has been placed at $160 per acre-foot.[31]

With skyrocketing expenses, one might expect that by now, Arizona farmers would be making an all-out effort to curb their use of water as much as possible. On the contrary, agricultural water-use figures increased steadily throughout the 1970's.[32] Part of this may be because of the continued federal water subsidies, but part of it may also be because few farmers are willing to make the very expensive initial investments needed to install water-saving equipment, even though it can save them money in the long run. Drip irrigation, for instance, can cost as much as $1,000 per acre to install.

At the same time, cotton and alfalfa--the most water-thirsty of the major crops grown in Arizona--are also the two most widely grown crops. While acreage devoted to these two crops has increased, acreage for less water demanding crops, such as vegetables, has declined.

Finally government tax structures and policies for allocating water from federally sponsored water projects often discourage conservation. Growers who practice water conservation actually can be "punished" by having their water allotments cut during subsequent growing seasons.[33]

Water problems also play an important role in the loss of farmland to urbanization in Arizona. As the state's cities expand out into the countryside, farmers living in their vicinity come under pressure to sell their property. Developers want their land for new housing construction,

non-farming neighbors may regard agricultural operations as an environmental nuisance, and city officials covet their water. Skyrocketing property taxes and irrigation costs provide the final incentives for many farmers to sell out.

Between 1965 and 1981, approximately 145,000 acres of irrigated cropland in Pima County went out of production, as Tucson's population and industries mushroomed.[34] The Groundwater Act of 1980 allowed cities to purchase and retire irrigated farmland, so that the water could be saved for other uses; Tucson has already bought 10,000 acres of farmland to obtain its water rights. While the total amount of cropland in Arizona has remained about the same for the past thirty years--around 1,2 million acres-- there has been a very significant change in where that cropland is located. Between 1967-1977, a yearly average of 32,000 acres of cropland (including 10,000 acres of prime cropland) was converted to other uses.[35] To make up the difference, new lands were opened for cultivation, often in remote desert areas, where soils tended to be more saline and less fertile and where ground and surface water were less readily available.

Arizona agriculture's extraordinarily high rate of energy consumption is directly linked to its tremendous demand for water. Overall, the U.S. food system is very inefficient in terms of energy expenditure. On average, it uses 6.4 units of commercial energy to produce each unit of food energy which reaches consumers.[36] Arizona's food system is even more wasteful. On Arizona farms, energy expenditures per acre of cropland are five times the national average.[37]

Except for the solar energy used by plants for photosynthesis, Arizona's food production system is powered almost entirely by fossil fuels. This situation is yet another point of vulnerability because fossil fuels are rapidly becoming scarcer and more expensive. Since many of these fuels are imported from other countries, international political or economic problems could cut off much of the supply. Nevertheless, energy use on Arizona farms, like water use, has continued to rise in recent years.[38]

Irrigation is a major factor behind Arizona's high rates of energy use; irrigation equipment accounts for about two-thirds of Arizona farmers' total energy bills.[39] As groundwater tables fall and surface water must be transported from greater distances, more energy is required. Other problems incurred by irrigation—soil and water salinization, geological subsidence, etc.—are corrected where possible but at great expense with mechanical and chemical technology that also require fossil-fuel based energy.

Arizona farmers' use of energy-expensive pesticides and chemical fertilizers also is high. In 1979, they applied almost 9 pounds of pesticides for each acre of cropland in the state, as compared with an national average of 2 pounds per acre. This amounts to 4 pounds of pesticides for every person in Arizona.[40] Though pesticide use increased rapidly in recent years (use of insecticides and herbicides more than doubled between 1966 and 1972[41]), there are indications that these pesticides are losing their effectiveness. For instance, a 1981 report in Progressive Agriculture in Arizona found that tobacco budworm resistance to methyl parathion increased tenfold between 1972 and 1978.[42]

At the same time, pesticide contamination of soil, air and water pose health hazards to wildlife, livestock and humans. A bulletin issued by the University of Arizona has cautioned farmers about growing wheat in soils previously used to grow cotton; residues from herbicides applied to the cotton crops may stunt the growth of wheat and other food grains.[43] In the Fall of 1980, many Arizona lemon orchard workers found out that they had been contaminated by DBCP, a pesticide banned by the EPA in 1979, but still present in drinking and washing water used in the orchard camps.[44]

Chemical fertilizers, like pesticides, are a major source of energy expenditure in agriculture and contribute to environmental pollution. In 1980, Arizona farmers used 541.4 pounds of fertilizer for each acre of cropland, as compared with a national average of 111 pounds per acre.[45] Chemical fertilizers have helped make some of the state's high crop yields possible, but they also may have had some undesirable side effects. Run-off from field fertilizers can contaminate bodies of water and create excessive algae growth, and fluoride emissions from phosphate manufacturing can damage plants and cause chronic fluorosis in cattle.[46]

Besides the environmental problems they may cause, chemical fertilizers are another source of vulnerability in Arizona's food system. Future supplies of phosphate, nitrogen, and potassium—the three most important chemical components of commercial fertilizers—are very uncertain at this time. Many of the mineral sources for these fertilizers are imported. For example, the United State's domestic supplies of phosphate may be exhausted by the turn of the century, at which time a small cartel of Mideastern nations could control world phosphate reserves to a much greater extent than OPEC now controls oil.[47] Current methods of nitrogen fertilizer

production require large amounts of natural gas, which is becoming scarcer and more expensive. The U.S. now imports over three-fourths of its potash--the major component of potassium fertilizers--and by the year 2000, potash imports could exceed 90 percent.[48]

Supporters of the status quo in Arizona agriculture might argue that the intensive use of water, fossil fuels, pesticides, and fertilizers by Arizona farmers is necessitated by the region's harsh climatic conditions, and justified by the high yields returned on some of the bigger crops. However, there is good cause to question whether the crops that Arizona farmers produce, and the way in which these crops are produced, are really beneficial to Arizona's economy and food system. Because of the orientation of state agriculture to a few huge cash crops, Arizona is in the interesting position of being a major exporter of a few agricultural commodities, and a net importer of most others. Arizona farmers earn 90 percent of their income from only 16 crops.[49] The largest crop in terms of acreage--cotton--is not a food item. Eight of the other largest crops--alfalfa, winter wheat, hay, corn, barley, sorghum, safflower, and sugar beets--are used primarily as animal feeds. On the other hand, Arizona growers have been turning away from vegetable and fruit crops in recent years. Between 1965 and 1980, lettuce production was reduced from 36,260 acres to 8,300 acres, potatoes dropped from 11,000 acres to 4,400 acres, and cantaloupes from 17,450 acres to 6,500 acres.[50] During the same period, cotton acreage jumped from 345,000 acres to 632,000 acres.[51]

Cotton is the preferred crop in Arizona because cotton prices tend to remain high and stable. As the University of Arizona publication, Progressive Agriculture in Arizona, explains it:

> Cotton has a high value per acre, so it can pay for the high costs of irrigation and pest control necessary for production in Arizona....Vegetables are another high-value crop, but their prices fluctuate more rapidly and more widely than cotton prices. This higher risk factor demands that vegetable growers have the capital strength to withstand bad seasons.[52]

Most crops in Arizona today are grown with national and international markets in mind. It is very difficult for Arizona vegetable and fruit growers to compete with rival growers in California, Texas, or Mexico, when the latter can often produce the same goods in large quantities, at less expense. As a result, Arizona's fruit and vegetable production is generally oriented towards off-season production for out-of-state markets, to fill the seasonal gaps left by other vegetable producing areas. Often this means that produce is grown under less than ideal weather conditions and suffers high spoilage in the process of being shipped to distant markets.

In the short term, cotton may indeed be more profitable for Arizona farmers than fruit and vegetable crops, but ultimately, making cotton the state's primary crop could spell disaster for Arizona's economy and food system. Cotton's high prices are due to heavy exports; in 1981, over 90 percent of Arizona's cotton crop was shipped overseas.[53] A heavy economic reliance on exports, just like a heavy reliance on imports, leaves an area vulnerable. If countries that import U.S. cotton should decide to become more self-sufficient, foreign demand could drop sharply, and the cotton market would disappear.

In the meantime, cotton crops occupy over one-third of Arizona's irrigated cropland, and require a much greater input of water, fertilizer, pesticide, and energy than do most food crops. It takes about 12,548 billion BTU's of energy to produce an acre of cotton, as compared to an average of 1,400 billion BTU's for an acre of vegetables.[54] Water use for cotton in Arizona is about 41 inches per season, as opposed to 25 inches for barley, 24 inches for potatoes, 19½ inches for sweet corn and 8½ inches for lettuce.[55] Cotton receives almost half (47 percent) of the insecticides used in the United States;[56] the detrimental effect of cotton pesticides on other crops grown for food has been previously noted.

Cottonseed meal can be used as a feed for cattle, but even this "contribution" to Arizona's food system may ultimately do more harm than good. In the late 1970's, high levels of carcinogenic aflatoxins showed up in the meat and milk of Arizona cattle. The aflatoxins were traced back to cottonseed meal feed.[57]

WHAT DO THESE FACTS MEAN?

With its wide range of microclimes, Arizona could produce almost any type of fruit, vegetable, or grain now consumed in the state. Few states can boast the potential to grow both hot weather crops like citrus fruits, olives, figs, and dates, and cool-weather produce like apples, potatoes, and broccoli. Yet, Arizona is importing many foods which could be grown right here at home. Imports mean vulnerability--vulnerability to crises that could shut off food supplies or make our food prohibitively expensive. It has been estimated that the average U.S. city has only a two to three days' supply of food; in the case of a food

"emergency," panic buying could empty grocery store shelves in a single day.[58] As cities like Phoenix and Tucson grow, surrounding truck farms disappear, and these cities become even more dependent on outside food sources.

Imports have other disadvantages besides increasing the danger of food shortages. They also make our food more expensive. The USDA has conservatively estimated that 5.3 percent of the American food bill goes to transportation costs.[59] In addition to this, consumers also must pay for government subsidies to the food transportation industry, and for food waste that occurs when food spoils in long distance shipping. Arizona's local economy is weakened when money is sent out of the state for food imports, because each dollar spent by an Arizona consumer will generate valuable local business.

A third disadvantage of imported food should be obvious to anyone whoever compared the tastes of a fresh-from-the-garden grown tomato with that of the "cellophane" tomatoes found in most grocery stores. Food shipped from distant places just doesn't taste as good as local produce. Moreover, long-distance food is less nutritious. Fruits and vegetables, for instance, are apt to lose much of their vitamin content through premature harvesting, overhandling and the longer period of time that it takes for the food to reach the consumer.

Even if a particular type of food is grown in sufficient quantities within the state to meet the demands of Arizona consumers, there is no guarantee that Arizona actually is self-sufficient in that food. Arizona has relatively few facilities for receiving, processing, packaging, and storing foods, so Arizona produce is often shipped out of the state for

processing, and then, perhaps, shipped back into the state for retail sales. An example of this problem is the beef situation in Arizona. Arizona is one of the few states which has enough cattle to produce a surplus of beef, but the state actually is a net importer of beef because there are not enough slaughterhouses in Arizona to process the meat.[60] Orange juice is another case. Despite Arizona's huge orange crop, 70 percent of which is exported, almost all fresh, frozen or canned orange juice found on the shelves of Arizona grocery stores comes from Florida or California.

Arizona is a net exporter of many foods, such as milk, lettuce, cabbage, onions, citrus fruits, etc. In the short term, food exports can benefit the state's economy by bringing in cash income, creating jobs in the food production sector, and helping to pay for other goods that the state must import. However, there are serious dangers in gearing the state's agriculture towards a few cash crops. The export crops displace other food crops, which subsequently must be imported into the state. In the event of a transportation shutdown, Arizona would not be able to ship its surplus crops to market and also would be unable to obtain imported foods. By encouraging export agriculture, Arizona is promoting a national food system that wastes food, energy and money through long distance transportation. Commercial, large scale export agriculture also leads to lack of crop diversity, increasing the danger that the few crops grown may be wiped out by disease or insect infestations.

WHAT CAN WE DO?

The facts about Arizona's food system are alarming, but the situation is not hopeless. One of the main factors behind Arizona's various

food problems is a lack of clear-cut, long term planning and goals. If such planning and goals were developed, there would be many things that Arizonans--farmers, consumers, business people, educators, researchers and government officials--could do to create a food system that would best serve their needs. Such a food system could be productive, dependable, sustainable, safe, efficient, and self-reliant.

A productive Arizona food system would give every person in the state access to adequate food--adequate in quantity, quality, and degree of choice. A dependable system would provide all Arizonans with a reliable food supply, free from economic, political or environmental disruption. A sustainable system would insure that cultural, economic, and environmental conditions of food production, processing, and distribution would permit the food system to be productive indefinitely--despite possible changes in climate, availability of resources, political upheavals, etc. Safe means the food system would not harm workers, consumers, or the environment. An efficient system would make the most economic use of energy, water, soil nutrients, and other resources.

The last term, self-reliant should not be confused with self-sufficient. We are not necessarily saying that Arizona should produce all of its own food. Even with Arizona's wide range of climates, there are some popular food items--bananas, coffee, tea, pineapples, cocoa--that cannot easily be grown here. Arizonans should try to produce enough of our food in sufficient variety so that we could 1) lower the cost and improve the quality of the food we consume, 2) be prepared for a sudden cutoff of food from outside the state, 3) strengthen our local

economy by keeping more of the food business at home, and 4) diversify our agricultural production system, thereby making it more reliant in times of stress--both environmental and economic.

These are not unrealistic goals. Arizona already produces about half of its own food. Still, we can and should do much better than that. Arizona has the potential to produce virtually all of its own vegetables, fruits, grains, meat, and dairy products-if we decide that is what we want to do.

The biggest problem currently facing Arizona food production is the water question. If Arizona agriculture is to be sustainable, it must learn to use less water. Present water consumption rates in the state cannot continue indefinitely, even if CAP is successfully completed. Continued overdrafting of groundwater reserves would be ecologically disastrous, and an act of suicide for the state's farmers.

Among the fifty states, Arizona ranks number eight in its consumption of water. It ranks twenty-ninth in population. Obviously, Arizonans could do more to conserve. Some water savings could come from domestic users in the cities; anyone who has seen the lush lawns, golf courses, giant fountains and even artificial lakes in Phoenix or Tucson could testify to this. However, 88 percent of all water in the state goes to agriculture, so plainly, most of the conserving must come from the farmer.

FARMERS

What can farmers do to save water? To begin with, they should work towards developing crops that are better adapted to the Southwest Desert environment, rather than struggling to adapt the environment to temperate climate crops. Fortunately, there is a growing amount of research being

conducted in this area, by scientists at the University of Arizona and by private individuals on Arizona farms. In the Sonoran Desert, workers at the Arizona Agricultural Experiment Station have identified nearly 400 wild species of plants used by desert Indians as food, plus at least 500 more once used for medicine, fiber or other purposes.[61] Many of these plants could be adapted to cultivation, using little or no irrigation. One such example is buffalo gourd, a prolific "weed" native to the Southwest Desert, which requires only 10-16 inches of water annually. Various parts of this plant can be made into a high protein flour, edible oils, food starches, or syrups for human consumption--or it can be used as an animal feed. Tepary beans, used by Arizona Indians as a wild and a cultivated food source, can reach maturity on as little as eight to ten inches of rainfall. In cooking, they can be used like pinto beans, to which they have a similar protein content. Even the tumbleweed-symbol of the dry, "dead" desert in many Western movies--has parts which can be eaten.

Instead of growing crops primarily for export, Arizona growers should devote more attention to producing a wider variety of crops that better meet local consumer demand, while also using less water. Cotton and alfalfa together occupy over half the cropland in Arizona. Each requires about twice as much water as the major grains and vegetables grown in the state, but neither is used directly as human food. It would be a wise step, in the long term, for Arizona growers to move away from these crops and devote more of their land to producing a diversity of fresh vegetables, fruits, grains, legumes, nuts, etc. Farmers and consumers could benefit by experimenting with food crops from other parts of the world that have arid climates like our own. Pearl millet,

for instance, might be a good crop for the Southwest deserts. A highly nutritious grain, millet is regarded only as "birdseed" by most Americans, but is a dietary staple for people in many of the drier regions of Asia and Africa.

By reducing their consumption of beef and other meats, Arizonans could save money and help conserve water. It takes about 2,800 gallons of water to produce one eight ounce steak, as compared to 408 gallons for 8 ounces of chicken meat and 12 gallons for 8 ounces of potatoes.[62]

When irrigation is needed, farmers should strive to implement methods that use minimal amounts of water. A 1976 GAO study estimated that 50 percent of all irrigation water in the U.S. was wasted.[63] For years, the "open ditch" method of agricultural irrigation predominated in the U.S. West. It was simple and relatively cheap (because the Federal Government subsidized the water), but it used six times as much water as sprinkler systems and one hundred times as much water as drip irrigation.[64] The traditional high-pressure nozzles used in sprinkler irrigation lose 20 percent to 30 percent of their water to evaporation before it even hits the ground.[65] By shifting towards drip irrigation and low-pressure sprinkler nozzles, Arizona growers could save tremendous amounts of water. Such changes are, of course, expensive. The Arizona State Government could help by providing tax breaks and other financial incentives for farmers who install such equipment. On the other side of the coin, the Groundwater Act of 1980 should do a great deal to enforce water conservation among <u>all</u> users and end the overpumping of groundwater. The Act does have a couple of questionable aspects as far as Arizona's

food system is concerned--the fact that the overpumping provision does not become completely effective until 2025, and the provision encouraging cities to buy out farmland for the water rights.

There are still other methods farmers can use to lessen their dependence on irrigated water. Leveling makes cropland as flat as possible, thus minimizing runoff loss. Land imprinting machines create small rills in the soil and crush existing vegetation into mulch, thus increasing the soil's water retention. Water catchment--a technique used centuries ago by Southwest Indians--involves the use of compacted soils, asphalt, plastic or other impermeable surfaces to trap water from rainfall and flash floods. The water is subsequently stored in reservoirs for future use. Properly treated effluent, from residential and industrial use, could also be used for irrigation.

Reductions in water used for irrigation would inevitably lead to farm energy savings. Further energy savings could be achieved by reduction in the use of chemical fertilizers, pesticides, and fossil-fuel burning farm machinery. Emphasizing biological control alternatives to pesticides could help alleviate such problems as increasing pest immunity and contamination of the environment as well as reducing consumption of petrochemicals needed to manufacture pesticides. Farmers could reduce dependence on chemical fertilizers by making use of on-farm fertilizer sources, such as nitrogen-fixing legumes, green manure crops, and animal manures. Organic wastes from municipalities might also be used. By practicing crop rotation, crop diversification, and periodically allowing fields to stand fallow, farmers could reduce need for both fertilizers and pesticides. The state of Arizona and local governments

could encourage such trends by enacting strict laws regulating the use of potentially hazardous pesticides and fertilizers, and by sponsoring research in natural pest control and fertilizer production. Growing more food locally would also help protect Arizona consumers from exposure to hazardous pesticides. A large portion of Arizona's food imports now come from Mexico, where pesticide regulations are much more lenient and not as well enforced as they are in the United States.

Just as they could develop on-farm sources of fertilizer, Arizona farmers could do a great deal to develop on-farm sources of energy. Certainly, if there is any place in the U.S. with a potential for solar-powered agricultural technology it is the sunny state of Arizona. Numerous oil crops native to the Southwest deserts--such as guayule, jojoba, or gopher plant--could be viable alternatives to many petroleum-based products. Greenhouses could be used to extend growing seasons, especially in cooler areas of the state.

By establishing more in-state industries to collect, process, package, and sell locally grown foods, Arizonans would save the energy and money now wasted sending foods out of the state for processing, then back into the state for retail sales. If this action were taken in regard to the beef industry, for instance, Arizona could become self-sufficient in beef, without increasing the number of cattle raised in the state.

CONSUMERS

Consumers can encourage more local production and processing of food by educating themselves as to where food comes from and what is done to it. They can then express their desire for more fresh, locally

produced produce to food retailers and patronize farmers markets, where food can be purchased directly from the growers. Consumers who live in urban areas can join food co-ops or buying clubs which contract with Arizona farmers. These organizations not only promote local food production, they also can save the consumer money and improve food quality by buying in bulk, eliminating "middlemen" profits, and cutting down on unnecessary processing and packaging.

Going a step further, Arizona consumers could grow more of their own fresh produce. Even a small backyard garden in a city can make a significant contribution to a family's annual food supply, especially if surplus produce is preserved and stored for "off-season" months. Receiving more personal attention and care than the huge vegetable farms could ever hope for, family or neighborhood gardens could be much more efficient in their use of water, fertilizer and other resources. A survey by the State Department of Water Resources found that an average Tucson home with a lawn uses about 17,000 gallons of water per month during the summer to keep the lawn green. Arizona homeowners could put some of this water to a much more productive use by growing vegetables instead of grass.

STATE

The Arizona state government could encourage diversification of food production by providing technical assistance from extension agents and low interest, state guarantee loans to help farmers finance changes needed for starting new crops. A State Department of Agriculture, if one were created, along with the University of Arizona College of Agriculture,

could study the feasibility of bringing "new" crops into commercial production in Arizona. Such "new" crops could include indigenous wild plants that could be converted into domestic food crops, and dryland crops from other arid regions.

To promote diversification of crops, the state should encourage more small-scale food production operations as alternatives to the gargantuan farms which presently dominate Arizona's agriculture. Encouragingly, Arizona's trend towards larger and larger farms seems to have reversed during the last few years. Between 1975 and 1981, the number of farms and ranches in the state actually increased from 6,300 to 7,100.[66] However, it should be kept in mind that the long-term trend in both Arizona and in the United States has been towards larger and fewer farms. The state government could encourage more small farms by providing tax incentives—such as not taxing the first $10,000 of income earned from food produced for local consumption. Guaranteed state loans to new farmers, with deferred or reduced payment until five years after start-up (such loans are now provided in Minnesota) could encourage new people to enter farming. The state could also make a special effort to provide technical and organizational assistance for new farmers.

A major problem for small producers in Arizona is finding a market. They often have problems transporting their produce to urban markets, and commercial food buyers often only want to buy in large quantities which small-scale growers can't produce. By forming producers' co-ops and self-help groups, small-scale farmers could increase their marketing potential. At the same time, farmers markets and food-buying co-ops

would encourage consumers to buy more food produced by small, local operations. Farmers could also deal more directly with consumers by establishing more roadside stands and "pick-your-own" operations. State and local governments could help promote more farmers markets (including wholesale markets to supply retailers), give preference to Arizona-grown food when purchasing food for use in government institutions, promote and provide assistance for food processing operations that buy local products, and provide assistance to small-scale growers through a statewide marketing clearinghouse. Arizona could also learn from those states which promote local foods through advertising campaigns and use a logo to identify foods produced within the state.

Arizona also must take action to prevent the loss of good farmland to urban expansion and the subsequent movement of farms to areas where soil quality and water availability are poorer. To this end Arizona might wish to emulate California, which undertook a computerized mapping and inventory of all its farmland, in order to safeguard such land from development.[67] With information from this inventory, Arizona could identify the current status and potential of all of its farmlands, as well as assess the availability of other lands for new agricultural operations.

Arizonans might also look to New York State, which has established agricultural districts, to protect farmland from urban expansion. In Suffolk County, New York, farmers who sell their development rights are paid the difference between the value of their land for development and the land's value for agriculture. This policy helped keep land in crops, and was so popular that Suffolk County residents actually voted to raise their taxes to finance it.[68]

State tax policies could also serve to discourage conversion of farmland to nonagricultural uses. Some existing Arizona tax laws already serve this purpose; for instance, farms are taxed at current use value, rather than potential market value. This law is especially important to farmers living in areas of urban development where property value and property taxes are skyrocketing.

Additional taxes that Arizona should consider include stiff levies imposed on profits made by developing prime agricultural land, and a farm capital gains tax that would discourage putting prime cropland on the speculative market.

Borrowing an idea from France, Arizona might wish to consider a policy that would allow the state "first refusal" rights to any farmland up for sale. In this system, farmers planning to sell their land are legally required to notify a state-chartered, non-profit corporation of their intention to sell. The corporation has a right to buy the farmland within thirty days. If it does so, it will resell the land only to farmers who agree to keep using it for commercial farming.[69]

The suggestions listed above combine a strong organizational and self-help effort among Arizona's farmers, consumers, and businesses with technical, informational, and financial help from the state government. However, if this assistance from the state is to be forthcoming, there must be one important, long overdue change in Arizona's state government--the creation of a State Department of Agriculture. Better yet would be the creation of a State Department of Food and Agriculture.

In 1978, Arizona consumers were frightened by reports of high levels of carcinogenic aflatoxins found in the milk of Arizona cows. One of the most upsetting aspects of this crisis was the fact that none of the

state's twenty-plus agriculture-related agencies could be fully held accountable for the problem. As a result, the state government was not able to react to the situation quickly. This prompted Governor Bruce Babbit to call for the creation of a single State Agriculture Department that would consolidate all the little agencies and effectively regulate overall food production.[70] Babbit's proposal died in the state legislature.[71]

Babbit's primary concern in advocating a Department of Agriculture appears to have been insuring food safety and quality. However, such a department could serve many other functions that would benefit all Arizonans. It could help develop state food strategies and coordinate these strategies with farmers, consumers, the food industry, and the federal and local governments. It could assist farmers with research and development, diversifying production, and conserving water and other resources. It could encourage the start of new farms and promote consumption of Arizona-produced food. It could serve as a stronger voice in government for the interests of farmers (especially small farmers) trying to protect their land and resources from development. It could also help develop a state emergency food plan, to deal with contingencies that might disrupt Arizona's food supplies from outside areas or problems threatening Arizona's own food production, such as crop failures. Achieving greater local self-reliance in food production would be one of the most important components of this plan. Other steps might include establishing state emergency food storage facilities, encouraging home and community storage of basic foodstuffs, and setting up a statewide network of communication and coordination centers through existing civil defense organizations, to deal with food emergencies.

Above all, an Arizona Department of Agriculture and Food Policy could develop badly needed long-term planning for a safe, efficient, sustainable, self-reliant state food system that would best serve the needs of all Arizonans--now, and in the future.

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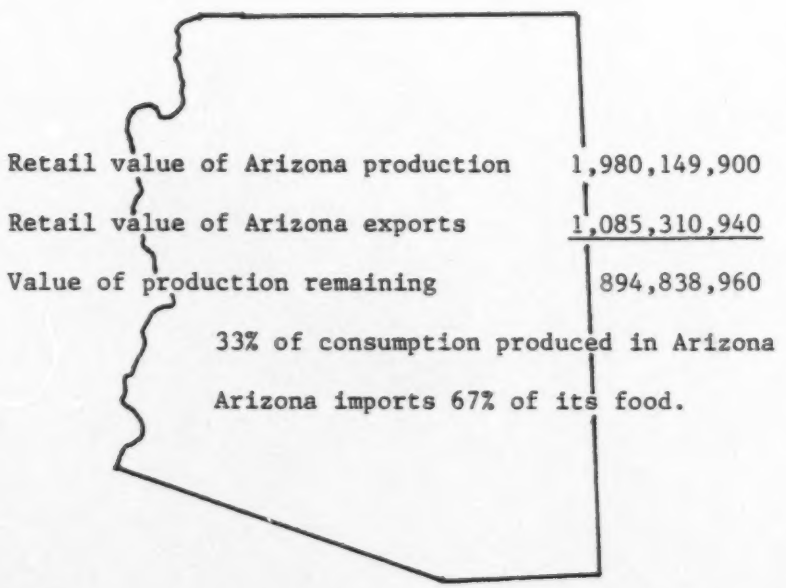
APPENDIX

Arizona's agricultural potential is impressive. In 1980, Arizona ranked second of all states in production of durum wheat, lettuce, grapes, and lemons. It ranked third in production of tangerines, fourth in grapefruit, and fifth in fresh market vegetables. Southern Arizona receives 85 to 90 percent of all possible sunshine in a given year, and many farmers enjoy 240 frost free days of growing. Despite these successes, 67 percent of the food Arizonians eat is imported. In many cases, Arizona imports the same foods it exports. Erosion and increasing demands on limited water resources threaten Arizona's future food production, as does loss of agricultural land due to development.

To begin to recognize and solve the weaknesses in Arizona's food system, a State Department of Food and Agriculture needs to be established. Further research should be done on food crops suitable for dryland farming, as well as energy and water efficient irrigation systems. Crops grown for export need to be carefully balanced with food crop production for in-state consumption. A network of markets and buyers is needed to assure that farmers receive fair and consistant prices for their food crops.


Retail value of Arizona production 1,980,149,900
Retail value of Arizona exports 1,085,310,940
Value of production remaining 894,838,960
33% of consumption produced in Arizona
Arizona imports 67% of its food.

ARIZONA FOOD IMPORTS

COMMODITY	PRODUCTION Retail Weight[a] (1,000 lbs)[d]	PRODUCTION Retail Value ($1,000)[b] (1981 dollars)	CONSUMPTION Retail Weight (1,000)[c]	CONSUMPTION Retail Value ($1,000)[b] (1981 dollars)	% Import	Retail Value of Import ($1,000)	% Export	Retail Value of Export ($1,000)	Acres required to produce 100% of AZ Consumption
Meats									
Beef	160,272.8	378,243.8	216,342.0	510,567.12	26.0	132,323.32			2,836,717.0
Lamb/Mutton	87.16	260.61	3,533.0	10,563.67	97.5	10,203.06			1,177.7
Pork	38,441.65	52,280.64	175,524.0	238,780.64	78.1	186,487.67			192,080.0
Veal	155.52	1,178.35	4,349.0	33,008.91	96.4	31,830.56			k
Poultry									
Chicken	Insignificant[e]	Insignificant	139,970.0	104,977.5					59,987.1
Eggs	14,753.0[f]	8,296.96	97,300.0	54,715.72	84.8	46,418.76			7,230.6
Turkey	Insignificant	Insignificant	27,400.0	27,340.64					19,116.0
Fish	Insignificant	Insignificant	36,147.68	84,585.42	100.0			84,585.42	
Dairy									
Cheese	NC[g]	NC	60,336.6	162,305.45					
Condensed and Evaporated Milk	NC	NC	20,655.8	30,983.7					
Dry Milk	NC	NC	9,240.74	19,347.80					
Fluid Milk and Cream	1,060,000.0	285,405.0	627,827.04	169,042.43			40.8	116,362.57	80,252.0[l]
Ice Cream	25,444.0	98,824.50	47,562.65	184,733.35	46.5	85,908.85			

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ARIZONA FOOD IMPORTS

COMMODITY	PRODUCTION Retail Weight (1,000 lbs)	PRODUCTION Retail Value ($1,000) (1981 dollars)	CONSUMPTION Retail Weight (1,000)	CONSUMPTION Retail Value ($1,000) (1981 dollars)	% Import	Retail Value of Import ($1,000)	% Export	Retail Value of Export ($1,000)	Area Required to produce 100% of AZ Consumption
Fresh Vegetables									
Broccoli	4,400.0	4,356.0	38,050.01	3,766.96			12.6	589.04	559.6
Cabbage	95,300.5	28,685.45	23,645.43	7,117.28			75.2	21,508.17	1,001.9
Carrots	27,500.0	8,470.0	16,578.98	5,106.33			39.7	3,363.67	1,201.4
Cauliflower	20,500.0	26,445.0	3,533.22	4,557.85			82.8	21,896.46	430.9
Celery	NC	NC	20,383.00	7,786.69					422.9
Cucumbers	NC	NC	11,686.82	4,569.85					1,082.1
Dried Peas	NC	NC	434.9	152.22					315.14
Dried Edible Beans	NC	NC	17,384.3	8,871.11					11,938.4
Garlic	NC	NC	2,989.65	2,965.98					230.0
Lettuce	829,900.0	406,651.0	70,936.0	34,758.79			91.5	371,892.2	3,138.8
Onions	62,300.0	23,300.2	32,070.81	11,994.48				11,305.72	720.7
Peas	NC	NC	1,087.15	3,239.71					310.6
Peppers	NC	NC	9,512.53	8,466.15					980.6
Potatoes	127,600.0	34,834.0	143,503.0	39,176.41	11.1	4,348.58			4,948.3
Rutabaga/Turnip	44,611.0	2,631.99	NC	NC					1,119.1
Snap Beans	NC	NC	3,805.01	2,347.69					
Spinach	30,008.93	14,704.37	1,358.93	655.88			95.5	14,038.49	186.15
Sweet Corn	NC	NC	20,112.21	6,033.66					2,545.8
Sweet Potatoes	NC	NC	11,958.61	5,859.72					1,172.4
Squash (pumpkin)	5,090.72	3,003.52	1,630.72	926.12				2,007.4	NC
Tomatoes	11,771.68	7,604.50	34,516.9	27,297.92	72.1	19,692.92			2,054.6
Frozen Vegetables									
Asparagus			217.43	269.70					108.7
Broccoli			3,723.48	4,654.35					557.1
Brussels Sprouts			788.18	827.59					88.4
Carrots			2,962.48	2,636.61					357.6
Cauliflower			1,358.93	1,658.07					1,550.2

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ARIZONA FOOD IMPORTS

COMMODITY	PRODUCTION Retail Weight (1,000 lbs)	PRODUCTION Retail Value ($1,000) (1981 dollars)	CONSUMPTION Retail Weight (1,000 lbs)	CONSUMPTION Retail Value ($1,000) (1981 dollars)	% Import	Retail Value of Import ($1,000)	% Export	Retail Value of Export ($1,000)	Area Required to produce 100% of AZ Consumption
Frozen Vegetables (cont.)									
Corn			2,799.4	2,435.48					425.2
Limas			1,386.11	1,441.55					589.9
Onions			2,038.34	1,977.19					55.0
Peas			4,729.09	3,641.40					1,468.7
Potatoes			44,193.37	31,975.69					3,765.8
Snap Beans			3,342.98	3,242.69					1,310.6
Spinach			1,984.04	1,488.03					271.8
Canned Vegetables									
Asparagus			8,153.36	3,424.51					414.5
Beets			2,717.87	1,549.0					113.9
Carrots			1,358.93	774.59					131.3
Lima Beans			1,087.15	837.11					434.8
Peas			8,697.17	6,522.88					2,061.0
Pickles			23,373.64	18,698.91					1,701.5
Sauerkraut			3,533.23	42,013.94					134.8
Snap Beans			16,307.2	9,621.25					3,414.9
Spinach			2,174.3	1,938.61					131.8
Squash/Pumpkin			1,630.72	1,027.35					NC
Sweet Potatoes			3,805.01	2,625.46					427.5
Tomatoes (Whole)			15,763.62	9,615.81					520.4
Catsup, Paste, etc.			39,409.06	23,645.44					4,253.0
Tomato Puree			2,714.29	1,326.32					524.6
Tomato Vegetable Juices			7,610.03	3,044.61					
Corn			14,948.26	7,324.65					1,525.3
Fresh Fruit									
Apples	NC	NC	47,019.08	29,669.04					3,616.8
Apricots	332.44	383.70	271.8	323.4			15.7	60.24	197.9

(Continued on next page)

ARIZONA FOOD IMPORTS

COMMODITY	PRODUCTION Retail Weight (1,000 lbs)	PRODUCTION Retail Value ($1,000) (1981 dollars)	CONSUMPTION Retail Weight (1,000 lbs)	CONSUMPTION Retail Value ($1,000) (1981 dollars)	% Import	Retail Value of Import ($1,000)	% Export	Retail Value of Export ($1,000)	Area Required to produce 100% of AZ Consumption
Bananas	None	None	58,162.33	20,124.17	100.0	20,124.17			NA
Cantaloupes	90,700.0	44,443.0	24,189.0	11,852.61			73.3	32,590.39	1,727.8
Grapefruit	192,000.0	85,056.0	20,655.78	9,150.51			89.2	75,905.49	908.0
Grapes	6,200.0	5,660.6	9,240.74	8,436.8	32.9	2,776.2			4,708.3
Honeydew Melon	24,000.0	11,760.0	NC	NC					
Lemons	231,800.0	195,639.2	5,435.73	4,587.76			97.7	191,051.44	475.1
Oranges	262,500.0	111,300.0	34,245.11	14,519.93			86.9	96,719.70	2,043.0
Peaches /Nectarines	26,659.88	13,703.18	19,568.64	10,058.28			26.6	3,644.9	653.3
Pears	NC	NC	6,794.67	4,008.86					989.2
Plums/Prunes	26,188.22	9,982.23	4,892.16	2,397.16			75.8	7,495.07	
Strawberries	NC	NC	5,435.73	5,464.72					1,168.5
Sweet Cherries	NC	NC	3,533.2	4,557.9					271.3
Tangerines	4,500.0	26,550.0	4,076.8	2,405.31			90.9	24,144.69	297.2
Watermelon	57,200.0	972.4	3,397.33	5,775.47			40.7	3,948.53	2,022.2
Fats and Oils									
Butter	NC	NC	12,502.2	25,004.4					
Lard	3,193.1	1,693.62	7,066.46	3,745.22	54.8	2,052.6			m
Margarine	NC	NC	31,255.45	24,504.28					
Oils	NC	NC	62,782.7	99,824.49					
Shortening	NC	NC	51,367.67	39,039.43					
Grains									
Barley	0.0[h]		3,261.44	1,141.50	100.0				906.0
Cornmeal	22,000.0	7,260.0	20,927.58	6,906.1			4.9	353.9	3,737.1
Corn Starch	NC	NC	5,163.84	3,253.29					
Oats	NC	NC	8,697.17	6,957.74					4,996.1

(Continued on next page)

ARIZONA FOOD IMPORTS

COMMODITY	PRODUCTION Retail Weight (1,000 lbs)	PRODUCTION Retail Value ($1,000) (1981 dollars)	CONSUMPTION Retail Weight (1,000 lbs)	CONSUMPTION Retail Value ($1,000) (1981 dollars)	% Import	Retail Value of Import ($1,000)	% Export	Retail Value of Export ($1,000)	Area Required to produce 100% of AZ Consumption
Rice	NC	NC	25,004.37	13,752.40					5,449.9
Rye	NC	NC	2,174.0	869.72					2,313.4
Wheat Flour	192,600.0	42,372.0	326,143.92	71,751.66	40.9	29,379.66			67,946.6
Processed Fruit									
Dried Fruit	NC	NC	8,398.21						
Fruit/Canned	NC	NC	52,726.6						
Frozen Fruit	NC	NC	6,984.81						
Orange Juice	NC	NC	152,825.6						
Miscellaneous									
Coffee, Tea, Cocoa	None	None	32,342.6	102,202.61	100.0				NA
Honey	4,620.0	7,854.0	3,533.27	6,006.55			23.6	1,847.45	
Maple Syrup	NC	NC	271.8	1,329.10					
Peanuts	NC	NC	19,296.85	45,154.63					7,421.9
Sugar (Beets)	54,496.0[i]	19,073.06	257,925.5	90,273.9	78.9	71,200.3			49,601.0
Tree Nuts (Pecans)[j]	1,775.05	11,360.32	4,892.2	31,310.08	63.7	19,949.76			27,913.7
TOTALS	3,758,901.89	1,980,149.90	3,455,033.7	2,713,240.96		662,696.41		1,085,310.94	3,446,622.39

Arizona Food Imports Chart

Footnotes

a. Production weights are from 1980 Arizona Agricultural Statistics; Arizona Fruit and Vegetable Shipments Crop Year 1979-80; the Arizona Crop and Livestock Reporting Service; and the University of Arizona Department of Agriculture.

b. Prices were supplied by the U.S. Department of Labor, Bureau of Labor Statistics; Safeway Supermarkets, Tucson; and Food Conspiracy Co-op, Tucson.

c. Consumption in Arizona based on per capita consumption figures as they appear in Food Consumption, Prices, and Expenditures, Statistical Bulletin No. 656 (Washington, D.C.: GPO, 1980).

d. These production figures are generous, they assume no loss or waste between the producer and the consumer.

e. Insignificant production - quantity of production too small to be recorded.

f. 9,916,667 dozen.

g. NC - data not collected by any available source.

h. In 1980, Arizona produced 199,600,000 lbs. of barley, but all of this was used for livestock feed.

i. Sugar production and land requirements based on sugar produced from beets.

j. Consumption figure based on per capita consumption of all nuts, excluding peanuts. Production figures are for pecans exclusively, which are the only tree nut grown on a large scale in commercial operations in Arizona.

k. Veal is a by-product of the dairy industry.

l. Dairy cattle in Arizona are almost entirely lot-fed. Land requirements reflect acreage needed to grow necessary grains for feed.

m. Lard is a by-product of hog slaughter, land requirements are covered under pork.

Appendix 2

Arizona Food System Organizations

There are many organizations which, directly or indirectly, are working toward developing a sustainable food system in Arizona. The following is a selective list of organizations working with consumers, farmers, and the food industry of Arizona.

Agricultural Communicators in Education
314 Agricultural Building
University of Arizona
Tucson, AZ 85721
(602) 626-4999

Arizona Association of Conservation Districts
P.O. Box 66
Kirkland, AZ 86362
(602) 442-3254

Arizona Jojoba Growers Association
c/o William Howard O'Brian
4350 E. Camelback
Suite 210E
Phoenix, AZ 85018
(602) 959-6070

Arizona State Extension Services
Dr. Roy Rauschkolb, Director
Tucson, AZ 85721
(602) 626-4829

Central Arizona Project Association (for water resources)
1124 Arizona Title Building
Phoenix. AZ 85003

Cooperative Extension Service
Howard E. Jones, 4-H
Norma Redeker, Home Economics
Edward Parnee, Community and Rural Development
College of Agriculture
University of Arizona
Tucson, AZ 85721
(602) 626-0111

Desert Botanical Garden
John H. Rhuart
P.O. Box 5415
Phoenix, AZ 85010
(602) 941-1217

El Pueblo Center
101 W. Irvington Rd.
Tucson, AZ 85714
(602) 791-4546

Food for the Hungry International
Dr. Larry Ward, President
7729 E. Greenaway Rd.
Scottsdale, AZ 85260
(602) 998-3100

Freedom from Hunger Foundation/ Meals for Millions
Cynthia Anson, director
P.O. Box 42622
Tucson, AZ 85733
(602) 624-7963

Governor's Commission on Arizona Environment
206 S. 17th Avenue
Phoenix, AZ 85007
(602) 261-7803

Hunger Action Center
715 N. Park
Tucson, AZ 85719
(602) 623-7575

Inter-Tribal Council of Arizona
124 W. Thomas Road
Suite 301
Phoenix, AZ 85013
(602) 248-0071

Second Harvest
1001 North Central Avenue
Suite 303
Phoenix, AZ 85004
(602) 252-1777